What is claimed is:

1. A method of processing at least first and second time domain plethysmographic signals obtained from a patient, said method comprising the steps of:

performing a Fourier transformation on the first time domain plethysmographic signal to transform the first plethysmographic signal into a first frequency domain plethysmographic signal;

performing a Fourier transformation on the second time domain plethysmographic signal to transform the second plethysmographic signal into a second frequency domain plethysmographic signal;

computing a first power spectrum from the first frequency domain plethysmographic signal;

computing a second power spectrum from the second frequency domain plethysmographic signal;

performing a Fourier transformation on the first power spectrum to transform the first power spectrum into a first cepstrum;

performing a Fourier transformation on the second power spectrum to transform the second power spectrum into a second cepstrum; and

examining the first and second cepstrums to obtain information therefrom relating to a physiological condition of the patient.

2. The method of claim 1 wherein said step of performing a Fourier transformation on the first time domain plethysmographic signal comprises performing a fast Fourier transformation on the first plethysmographic signal, and wherein said step of performing a Fourier transformation on the second time domain plethysmographic signal comprises performing a fast Fourier transformation on the second plethysmographic signal.

3. The method of claim 1 wherein said step of computing a first power spectrum comprises squaring and summing real and imaginary frequency components of the first frequency domain plethysmographic signal, and wherein said step of computing

a second power spectrum comprises squaring and summing real and imaginary frequency components of the second frequency domain plethysmographic signal.

4. The method of claim 1 wherein said step of performing a Fourier transformation on the first power spectrum comprises performing a fast Fourier transformation on the first power spectrum, and wherein said step of performing a Fourier transformation on the second power spectrum comprises performing a fast Fourier transformation on the second power spectrum.

5. The method of claim 1 wherein the physiological condition of the patient comprises a pulse rate of the patient.

6. The method of claim 5 wherein said step of examining the first and second cepstrums comprises:

identifying a peak in the first cepstrum associated with the pulse rate of the patient;

identifying a peak in the second cepstrum associated with the pulse rate of the patient; and

estimating the pulse rate of the patient based on locations of the identified peaks in the first and second cepstrums.

7. The method of claim 6 wherein said step of identifying a peak in the first cepstrum associated with the pulse rate of the patient comprises choosing a largest magnitude peak in the first cepstrum, and wherein said step of identifying a peak in the second cepstrum associated with the pulse rate of the patient comprises choosing a largest magnitude peak in the second cepstrum.

8. The method of claim 6 further comprising:

utilizing a time domain based estimate of the pulse rate of the patient in said steps of identifying a peak in the first cepstrum associated with the pulse rate of the patient and identifying a peak in the second cepstrum associated with the pulse rate of the patient.

9. The method of claim 6 further comprising:

constructing a filter for removing motion artifacts based on at least the pulse rate of the patient estimated in said step of estimating.

10. The method of claim 9 wherein in said step of constructing, the filter comprises an adaptive bandpass filter having cutoff frequencies determined by a frequency of the pulse rate of the patient estimated in said step of estimating.

11. The method of claim 9 further comprising:

filtering the first and second time domain plethysmographic signals using the filter.

12. The method of claim 9 further comprising:

filtering the first and second frequency domain plethysmographic signals using the filter.

13. The method of claim 6 further comprising:

determining a DC level of the first power spectrum;

determining a DC level of the second power spectrum;

obtaining an AC level of the first time domain plethysmographic signal from the identified peak in the first cepstrum;

obtaining an AC level of the second time domain plethysmographic signal from the identified peak in the second cepstrum; and

computing a value correlated with a blood analyte level of the patient from the DC values of the first and second power spectrums and the AC levels of the first and second time domain plethysmographic signals.

14. The method of claim 13 wherein in said step of computing, the blood analyte level is an SPO2 level.

15. The method of claim 1 further comprising:

transmitting a red wavelength optical signal through a tissue site of the patient to obtain the first time domain plethysmographic signal; and

transmitting an infrared wavelength optical signal through the tissue site of the patient to obtain the second time domain plethysmographic signal.

16. The method of claim 1 further comprising:

applying a smoothing window to the first and second time domain plethysmographic signals prior to said steps of performing a Fourier transformation on the first time domain plethysmographic signal and performing a Fourier transformation on the second time domain plethysmographic signal.

17. The method of claim 16 wherein in said step of applying a smoothing window, the smoothing window comprises one of a Hanning window and a Hamming window.

18. The method of claim 16 wherein in said step of applying a smoothing window, the smoothing window comprises a Kaiser window.

19. The method of claim 1 further comprising:

scaling the first and second power spectrums with a logarithmic function prior to said steps of performing a Fourier transformation on the first power spectrum and performing a Fourier transformation on the second power spectrum.

20. The method of claim 1 further comprising:

analyzing the number and spacing of peaks present in the first and second cepstrums to obtain information relating to motion artifacts present in the first and second time domain plethysmographic signals.

21. A method of determining a pulse rate of a patient from at least one time domain plethysmographic signal obtained from the patient, said method comprising the steps of:

obtaining a time domain based estimate of the pulse rate of the patient from the time domain plethysmographic signal;

transforming the time domain plethysmographic signal to a spectral domain plethysmographic signal;

obtaining a spectral domain based estimate of the pulse rate of the patient from the spectral domain plethysmographic signal;

transforming the spectral domain plethysmographic signal to a cepstral domain plethysmographic signal;

obtaining a cepstral domain based estimate of the pulse rate of the patient from the cepstral domain plethysmographic signal; and

determining a best estimate of the pulse rate of the patient based on at least the time, spectral, and cepstral domain based estimates of the pulse rate of the patient.

22. The method of claim 21 wherein said step of transforming the time domain plethysmographic signal to a spectral domain plethysmographic signal comprises performing a Fourier transform operation on the time domain plethysmographic signal.

23. The method of claim 21 wherein said step of transforming the spectral domain plethysmographic signal to a cepstral domain plethysmographic signal comprises performing a Fourier transform operation on the spectral domain plethysmographic signal.

24. The method of claim 21 further comprising:

applying a smoothing window to the time domain plethysmographic signal prior to said step of transforming the time domain plethysmographic signal to a spectral domain plethysmographic signal.

25. The method of claim 24 wherein in said step of applying a smoothing window, the smoothing window comprises one of a Hanning window and a Hamming window.

26. The method of claim 24 wherein in said step of applying a smoothing window, the smoothing window comprises a Kaiser window.

27. The method of claim 21 further comprising:

deriving information relating to motion artifacts in the time domain plethysmographic from at least the spectral domain plethysmographic signal and the cepstral domain plethysmographic signal; and

including the information relating to motion artifacts in the time domain plethysmographic signal in said step of determining a best estimate of the pulse rate of the patient, whereby the best estimate of the pulse rate of the patient is based on at least the time, spectral, and cepstral domain based estimates of the pulse rate of the patient and the information relating to motion artifacts in the time domain plethysmographic signal.

28. The method of claim 27 further comprising:

constructing a frequency domain filter for removing motion artifacts based on at least the best estimate of the pulse rate of the patient, the spectral domain plethysmographic signal, and the information relating to motion artifacts in the time domain plethysmographic signal;

filtering the spectral domain plethysmographic signal with the filter to obtain a filtered spectral domain plethysmographic signal;

transforming the filtered spectral domain plethysmographic signal to a filtered time domain plethysmographic signal;

obtaining a filtered time domain based estimate of the pulse rate of the patient from the filtered time domain plethysmographic signal; and

including the filtered time domain based estimate of the pulse rate of the patient in said step of determining a best estimate of the pulse rate of the patient, whereby the best estimate of the pulse rate of the patient is based on at least the time, spectral, cepstral and

filtered time domain based estimates of the pulse rate of the patient and the information relating to motion artifacts in the time domain plethysmographic signal.

29. The method of claim 28 wherein said step of transforming the filtered spectral domain plethysmographic signal to a filtered time domain plethysmographic signal comprises performing an inverse Fourier transform operation on the filtered spectral domain plethysmographic signal.

30. The method of claim 28 further comprising:

scaling the spectral domain plethysmographic signal with a logarithmic function prior to said step of transforming the spectral domain plethysmographic signal to a cepstral domain plethysmographic signal to obtain a logarithmic scaled spectral domain plethysmographic signal;

obtaining a logarithmic scaled spectral domain based estimate of the pulse rate of the patient from the logarithmic scaled spectral domain plethysmographic signal; and

including the logarithmic scaled spectral domain based estimate of the pulse rate of the patient in said step of determining a best estimate of the pulse rate of the patient, whereby the best estimate of the pulse rate of the patient is based on at least the time, spectral, cepstral, filtered time and logarithmic scaled spectral domain based estimates of the pulse rate of the patient and the information relating to motion artifacts in the time domain plethysmographic signal.

31. A pulse oximeter comprising:

a first optical signal source operable to emit an optical signal characterized by a first wavelength;

a second optical signal source operable to emit an optical signal characterized by a second wavelength different than said first wavelength;

a drive system operable to cause operation of said first and second optical signal sources such that each of said first and second optical signal sources emit first and second optical signals, respectively, in accordance with a multiplexing method;

a detector operable to receive said first and second optical signals after said first and second optical signals are attenuated by a patient tissue site of a patient, said detector being further operable to provide an analog detector output signal representative of said attenuated first and second optical signals;

a digital sampler operable to sample the analog detector output signal at a desired sampling rate and output a digital signal having a series of sample values representative of said attenuated first and second optical signals; and

a digital processor enabled to demultiplex the series of sample values into first and second time domain plethysmographic signals, transform the first and second time domain plethysmographic signals into first and second spectral domain signals, transform the first and second spectral domain plethysmographic signals into first and second cepstral domain plethysmographic signals, and examine the first and second cepstral domain plethysmographic signals to obtain information therefrom relating to a physiological condition of the patient.

32. The pulse oximeter of claim 31 wherein said first wavelength is within the range of infrared light wavelengths and said second wavelength is within the range of red light wavelengths.

33. The pulse oximeter of claim 31 wherein said desired sampling rate is at least 50 Hz.

34. The pulse oximeter of claim 31 wherein said multiplexing method comprises at least one of frequency division multiplexing, time division multiplexing, and code division multiplexing.

35. The pulse oximeter of claim 31 wherein said digital processor is enabled to perform fast Fourier transforms on the first and second time domain plethysmographic signals to transform the first and second time domain plethysmographic signals into first and second spectral domain signals.

36. The pulse oximeter of claim 31 wherein said digital processor is enabled to perform fast Fourier transforms on the first and second spectral domain plethysmographic signals to transform the first and second spectral domain plethysmographic signals into first and second cepstral domain signals.

37. The pulse oximeter of claim 31 wherein the physiological condition of the patient comprises a pulse rate of the patient.

38. The pulse oximeter of claim 37 wherein said digital processor is further enabled to construct a frequency domain filter based at least on the pulse rate of the patient, filter the first and second spectral domain plethysmographic signals using the filter to obtain filtered first and second spectral domain plethysmographic signals, and transform the filtered first and second spectral domain plethysmographic signals into filtered first and second time domain plethysmographic signals.

39. The system of claim 38 wherein said digital processor is further enabled to determine DC levels of the first and second time domain plethysmographic signals, determine AC levels of the first and second filteréd spectral domain plethysmographic signals, and compute a value correlated with a blood analyte level of the patient from the DC values of the first and second time domain plethysmographic signals and AC levels of the first and second filtered time domain plethysmographic signals.

40. The pulse oximeter of claim 39 wherein the blood analyte level is an SPO2 level.

41. The pulse oximeter of claim 31 wherein said digital processor is further enabled to smooth the first and second time domain plethysmographic signals with a smoothing window prior to transforming the first and second time domain plethysmographic signals into first and second spectral domain signals.

42. The pulse oximeter of claim 41 wherein said smoothing window comprises one of a Hanning window and a Hamming window.

43. The pulse oximeter of claim 41 wherein said smoothing window comprises a Kaiser window.

44. The pulse oximeter of claim 31 wherein said digital processor is further enabled to scale the first and second spectral domain plethysmographic signals with a logarithmic function prior to transforming the first and second spectral domain plethysmographic signals into first and second cepstral domain plethysmographic signals.

45. A pulse arbitration method for use in determining a fundamental pulse frequency of a patient from multiple signal domains associated with at least one time domain plethysmographic signal obtained from the patient, said method comprising the steps of:

transforming the time domain plethysmographic signal to a spectral domain plethysmographic signal;

transforming the spectral domain plethysmographic signal to a cepstral domain plethysmographic signal;

examining the spectral and cepstral domain plethysmographic signals to identify corresponding spectral and cepstral domain plethysmographic signal peaks; and

using the identified corresponding spectral and cepstral domain plethysmographic signal peaks to select the fundamental pulse frequency from among a plurality of possible candidates for the fundamental pulse frequency of the patient.

46. The method of claim 45 wherein said step of transforming the time domain plethysmographic signal to a spectral domain plethysmographic signal comprises performing a Fourier transform operation on the time domain plethysmographic signal.

47. The method of claim 45 wherein said step of transforming the spectral domain plethysmographic signal to a cepstral domain plethysmographic signal comprises performing a Fourier transform operation on the spectral domain plethysmographic signal.

48. The method of claim 45 further comprising:

obtaining at least one candidate for the fundamental pulse frequency of the patient from the time domain plethysmographic signal; and

including the candidate for the fundamental pulse frequency of the patient obtained from the time domain plethysmographic signal in the plurality of candidates for the fundamental pulse frequency of the patient in said step of using the identified corresponding spectral and cepstral domain plethysmographic signal peaks to select the fundamental pulse frequency.

49. The method of claim 45 further comprising:

scaling the spectral domain plethysmographic signal with a logarithmic function to obtain a logarithmic scaled spectral domain plethysmographic signal;

obtaining at least one candidate for the pulse frequency of the patient from the logarithmic scaled spectral domain plethysmographic signal; and

including the candidate for the fundamental pulse frequency of the patient obtained from the logarithmic scaled spectral domain plethysmographic signal in the plurality of candidates for the fundamental pulse frequency of the patient in said step of using the identified corresponding spectral and cepstral domain plethysmographic signal peaks to select the fundamental pulse frequency.

50. The method of claim 45 further comprising:

obtaining at least one candidate for the fundamental pulse frequency of the patient from the spectral domain plethysmographic signal; and

including the candidate for the fundamental pulse frequency of the patient obtained from the spectral domain plethysmographic signal in the plurality of candidates for the fundamental pulse frequency of the patient in said step of using the identified corresponding spectral and cepstral domain plethysmographic signal peaks to select the fundamental pulse frequency.

51. The method of claim 45 further comprising:

obtaining at least one candidate for the fundamental pulse frequency of the patient from the cepstral domain plethysmographic signal; and

including the candidate for the fundamental pulse frequency of the patient obtained from the cepstral domain plethysmographic signal in the plurality of candidates for the fundamental pulse frequency of the patient in said step of using the identified corresponding spectral and cepstral domain plethysmographic signal peaks to select the fundamental pulse frequency.

52. The method of claim 45 further comprising:

constructing a frequency domain filter for removing motion artifacts based on at least the fundamental pulse frequency of the patient, the spectral domain plethysmographic signal, and information relating to motion artifacts in the time domain plethysmographic signal derived from at least the spectral domain plethysmographic signal and the cepstral domain plethysmographic signal;

filtering the spectral domain plethysmographic signal with the frequency domain filter to obtain a filtered spectral domain plethysmographic signal;

transforming the filtered spectral domain plethysmographic signal to a filtered time domain plethysmographic signal;

obtaining at least one candidate for the fundamental pulse frequency of the patient from the filtered time domain plethysmographic signal; and

including the candidate for the fundamental pulse frequency of the patient obtained from the filtered time domain plethysmographic signal in the plurality of candidates for the fundamental pulse frequency of the patient in said step of using the identified corresponding spectral and cepstral domain plethysmographic signal peaks to select the fundamental pulse frequency.